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TABLE OF CONTENTS

LIST OF TABLFS

INTRODUCTION

Few studies of the labor-market activity of wives have taken into account the labor-market activity of their husbands. In the literature, however, their husbands have not been totally ignored. In estimating the labor supply of wives, the use of the husband's wage rate as a regressor is widespread, and the theoretical implications thereof are common knowledge.

In conventional studies of demand, the utility function has as its arguments market goods and, as is the case here, leisure time of the husband and wife. Total time available to either husband or wife is divided into market and nonmarket, or leisure, time. Thus, maximizing the utility function subject to the household's budget constraint will yield the demand functions for the husband's and wife's nonmarket time, or their corresponding supply functions of labor. Implicit in this constrained maximization is the household's or individual's ability to freely vary all choice variables within the limits of prices and income. However, a survey of weekly hours of heads of households yields a less than uniform distribution of work hours. There is, for example, a dominant mode at exactly 40 hours per week. Among these heads are a fair percentage who would like to alter their work hours, but are unable to because of contractual obligations, unions, or tradition. For these households, the amount of the husband's time available to the household is fixed. To avoid the confusion

between fixed factors of production and fixed quantities of goods available to a household or individual, although the usual qualified analogy is appropriate, fixed quantities of goods will simply be called rationed goods. The effect of rationing the husband's nonmarket (market) time alters the labor-market activity of his wife. This study examines this effect and provides statistical proof that rationing exists.

Equally important to this study is the examination of the labor-market activity of the married woman whose husband works part-time. The Census Bureau defines full-time workers as those who work least 35 hours a week and at least 50 weeks annually. The complement of this set of workers will be designated part-time workers. Because of the many combinations of hours and weeks afforded part-time workers, it is assumed these households are not rationed the husband's nonmarket time. Instead, households with part-time working heads may have different tastes for leisure when compared to households with full-time working heads who are not rationed. This translates into contrasting vectors of labor-supply parameters for the wives from these two types of households.

Following the theoretical discussion in the next section, then, labor-supply functions will be estimated for wives from three types of households: (1) full-time working head of household whose time is rationed, (2) full-time working head of household whose time is not rationed (control group), and (3) part-time

working head of household whose time is assumed not to be rationed. The labor-supply elasticity for wives from the control group is the largest at 2.15. This research does find a rationing effect; the labor-supply elasticity for wives with full-time working husbands whose time is rationed is significantly smaller at 1.17. Moreover, in households with heads who work part time, a labor-supply elasticity of .41 is found for these wives. Given that wives from all three types of households work approximately the same number of hours annually, households with husbands who work part time have greater tastes for leisure. That is, for a given percentage increase in their wages, wives from households with greater tastes for leisure will increase their hours of work less than those with lesser tastes for leisure.

The labor-supply elasticity of the control group is smaller than the 4.31 Heckman reports in his 1976 paper on sample selection bias. He has pooled together the three types of households described above to get his one estimate. Pooling these three subsamples yields an estimate of 1.98. This result is significantly smaller than Heckman's, but is concordant with other earlier research. There are two reasons for the difference in these pooled results. First, Heckman uses the 1967 National Longitudinal Survey of Work Experience of Women Age 30-44, while the data used for this research is the Panel Study of Income Dynamics, 1975. Second, the work experience variable is more

accurately measured in this paper than Heckman's and also reflects less depreciation of human capital.

The report will follow this plan. In section I, a static model of labor supply with and without rationing is discussed. Comparisons between the corresponding own-wage effects and income effects constitute the primary focus. In section II, empirical estimates of the labor supply functions are analyzed. A discussion of the data and technique are also presented. The results show that the single labor-supply elasticity reported in earlier research should be trisected and its components analyzed and compared.

A STATIC MODEL OF THE LABOR SUPPLY OF WIVES: RATIONING VERSUS NONRATIONING

The time allocation decisions are the result of the household's attempt to maximize a well-behaved utility function subject to time and goods consumption constraints. Given the assumption of maximizing behavior, the supply of labor for the wife is a function of the household's prices, wages, nonwage income, and other constraints. Hence, applying the results from Samuelson's Foundations to labor supply, the objective here is present the relationships between the supply elasticities of wives whose husbands' time is rationed and those wives whose husbands' time is not rationed. As appendix A shows, there are four possible situations concerning the uncompensated own-wage effects and two possible

situations concerning income effects across households. To illustrate, consider the following own-wage and income effects.

First, one can show that the labor-supply of wives whose husbands' time is not rationed is more elastic than that of wives whose husbands' time is rationed. Here, the nonmarket time of the husband and that of his wife are substitutes. In addition, leisure is assumed to be normal throughout the discussion.

Assume that the rationed and unrationed households are in an initial equilibrium. The wife's wage increases and the rationed household adjusts the demand for the wife's nonmarket time according the relative magnitudes of the own-wage substitution effect and income effect. Assume the substitution effect dominates. Thus, if total time available to her is spent either in the market or in the household, this increase in her wage implies an increase in her hours-worked.

In the unrationed household, however, there is an effect in addition to that described above. The increase in her wage rate and subsequent decrease in demand for her nonmarket time (increase in her hours of work) increases the value of the husband's nonmarket time, given their nonmarket times are substitutes. The increase in the value of his nonmarket time increases the demand for it. Moreover, the increase in the wife's wage induces an income effect. Since leisure is normal, the income effect further

increases the demand for his time. Since their nonmarket times are substitutes, the increase in demand for his nonmarket time lowers the demand for her nonmarket time: this is the additional effect. The total effect for unrationed households, then, is the decrease in demand for her nonmarket time as in the case of rationed households decribed in the preceding paragraph plus this additional effect on the demand for her spouse's nonmarket time. The increase in her wage rate is to decrease the demand for her nonmarket time even more when compared to rationed households. In other words, for a given increase in her wage, the wife whose husband is not rationed will supply more hours than the wife whose husband is rationed; the supply elasticity is larger for wives with husbands whose time is not rationed.

Second, for a given increase in nonwage income, a larger decrease in the labor supply can be expected for wives of husbands whose time is rationed than for wives of husbands whose time is not rationed. Consider the case of extreme substitutability. As nonwage income increases, the household chooses to consume more nonmarket time or leisure of both husband and wife. However, for the household where the husband's nonmarket time is rationed, it cannot "consume as much" of his leisure time as it could if he worked flexible hours (as in the case of the unrationed household). Therefore, the rationed household to be "as well off" as an unrationed one, chooses to substitute toward more of the wife's nonmarket time as "compensation." In other words, for a given

increase in income, households with husbands whose time is rationed tend to have wives working relatively fewer hours than do households where the husband's time is not rationed.

EMPIRICAL RESULTS

The data source for this empirical analysis is the University of Michigan's A Panel Study of Income Dynamics: 1968-1975. Like other panel data sets, such as the Parnes' Older Women data set, the Income Dynamics data follows individuals over a number of consecutive years. During this period data are accumulated on wages, hours, children, and other market and household variables. Because of the design of the experience variable, which is discussed in more detail later, the 1975 interviewing year is used.

From the original sample of 5,725 observations, a subsample of 3,253 was drawn of households in which both husband and wife were present in 1974 and both were 55 years old or less. Farmers and the self-employed, for a total of 389 households, were excluded because of the inherent problem of separating from their income the returns to labor and capital. Further, exclusions were made owing to missing data on income, zero hours worked by the husband (11 percent of the subsample), education, and other variables crucial to this study. After excluding these households, 2,473 observations remained. Finally and most importantly, 916 households were excluded from the estimation of the hours-worked and

wage equations because the wife worked zero hours. Since these households comprise approximately 40 percent of the basic subsample, a sample-censoring bias is introduced on the parameter estimates. The censored-regression procedures correct this bias and conduce to consistent estimates. Failure to recognize the magnitude of the bias results in inaccurate estimates, as side-by-side comparisons with standard OLS make clear.

The sample used for this analysis, therefore, totaled 2,473 households (includes households in which the wife does not work). Separating these observations into rationed and unrationed households was not clear-cut. As already noted, households with husbands who work only part time are assumed to be not rationed. Such households choose jobs offering the desired number of work-hours; also, the data verify this assumption inasmuch as the variation in hours and weeks worked in this category is greater. Still, these households may simply have different tastes for leisure, and part-time working husbands may comprise a separate labor market.

Any one of a large number of combinations of hours-per-week and weeks-per-year could be used to make the division between full- and part-time working husbands. Using the Census Bureau definition of full-time workers, households classified as having full-time working husbands are those in which the husbands work at least 35 hours per week and at least 50 weeks per year. Of the

2,473 households, these numbered 1966, or approximately 80 percent of the sample. The remaining 507 households are classified as having part-time working husbands.

In most of the 1,966 households with full-time working husbands, the husband's time is not rationed. Rationed husbands are those who gave one of the two answers to questions pertaining to the choice of hours worked: (1) could not have worked more, but would have liked to, or (2) could not have worked less, but would have liked to (even if it meant less money). These rationed households totaled 580; either by virtue of contract of tradition, these husbands cannot alter the number of hours-per-week they worked. The remaining 1,386 constitute households where the full-time working husband's time is not rationed. A Definition of Variables list precedes table 1.

The sample statistics for the three types of household begin to show some basic differences (table 1 and table 2). First, the mean nonwage income received by households with part-time working husbands is nearly five times that of households with full-time working husbands. This finding was expected, since nonwage income represents the sum of transfers, such as Aid to Dependent Children with unemployed fathers, welfare, and workmen's compensation. Within households with full-time working husbands, the difference in nonwage income is negligible.

DEFINITION OF VARIABLES

WAGEW	Wife's hourly wage rate, computed by taking the ratio of her annual earnings in 1974 to her annual hours-worked in 1974. In the estimation, WAGEW is the natural log of the wife's wages.
WAGEH	Husband's hourly wage rate, computed by taking the ratio of his annual earnings in 1974 to his annual hours-worked in 1974.
AHOURW	Annual hours worked by the wife in 1974.
EXPW	Number of years worked by the wife since the beginning of the survey in 1968. Computed by summing up the number of years she reported a positive number of hours worked.
EDW	Number of years of education completed by the wife.
NWAGE	Total transfer income of husband and wife in 1974.
RACE	A dummy variable equal to one if the head of the household is white.
KID05	Number of children 5 years or younger.
LAMBDA	Inverse of Mills's ratio.

TABLE 1

SAMPLE STATISTICS FOR TOTAL SAMPLE

Type of household

Variable	Full-time working husband rationed		Full-time working husband not rationed		Part-time working husband assumed not to be rationed	
	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation
AHOURW	-	-	-	-	-	-
WAGEW	-	-	-	-	-	-
EXPW	3.46	2.43	3.55	2.50	3.42	2.46
EDW	11.36	2.10	11.94	2.32	11.71	2.80
NWAGE	238.52	824.01	249.82	827.90	1039.43	1509.70
RACE	.60	.49	.70	.46	.60	.49
KID05	.70	.85	.55	.74	.57	.76
WAGEH	4.53	2.04	5.16	2.49	5.43	3.92
SAMPLE SIZE	580		1386		507	

TABLE 2

SAMPLE STATISTICS FOR WORKING SUBSAMPLE

Type of household

Variable	Full-time working husband rationed		Full-time working husband not rationed		Part-time working husband assumed not to be rationed	
	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation
AHOURW	1260.53	686.39	1293.38	700.14	1270.72	670.11
WAGEW	2.94	1.72	3.44	2.31	3.70	3.54
EXPW	4.26	2.25	4.38	2.35	4.20	2.34
EDW	11.56	2.03	12.23	2.26	12.29	2.51
NWAGE	210.47	736.47	251.80	847.78	882.69	1365.15
RACE	.60	.49	.69	.46	.60	.49
KID05	.56	.76	.43	.66	.48	.71
WAGEH	4.53	2.04	5.16	2.49	5.43	3.92
SAMPLE SIZE	361		859		337	

Part-time working husbands show greater job mobility. All husbands have approximately the same job experience, 17 years. The difference is in job tenure. For full-time working husbands, the mean number of years of job tenure is 6.5, while that of part-time working husbands is 3.5. Moreover, the annual hours worked by part-time workers is approximately half that worked by full-time workers, and is equal to that worked by their wives. Finally, the mean wages of the part-time working husband and his wife are higher than the corresponding wages in households with full-time working husbands. Hence, households with part-time working husbands have higher reservation wages, implying greater tastes for leisure.

Specification of Labor-Supply Functions, Labor-Force Participation Functions, and Market-Wage Equations

As in earlier studies, specification of the labor supply functions herein is conventional. The conventional treatment thereof allows for comparisons between the results of the present study and those of earlier research. Linearity is assumed between the wife's hours-worked and its determinants, which include wage rates, nonwage income, and a set of household variables. The following specification is used for the wife's shadow wage or labor-supply function:

$$\begin{aligned} AHOURW_i = a_0 &+ a_1 WAGEW_i + a_2 WAGEH_i + a_3 NWAGE_i + a_4 EDW_i \\ &+ a_5 RACE_i + a_6 KIDO5_i + e_{1i} \end{aligned} \tag{1}$$

Her market wage equation is also presumed to be linear, and is written as

$$WAGEW_i = b_0 + b_1 EXPW_i + b_2 EDW_i + b_3 RACE_i + e_{2i} \tag{2}$$

Her labor-force participation decision is governed by

$$\begin{aligned} LFP_i = c_0 + c_1 EXPW_i + c_2 EDW_i + c_3 WAGEH_i + c_4 NWAGE_i \\ + c_5 RACE_i + c_6 KID05_i + e_{3i} \ , \end{aligned} \tag{3}$$

where $LFP_i = 1$, if $AHOURW_i > 0$, and $LFP_i = 0$, if $AHOURW_i = 0$.

Since $EXPW_i$ is equal to the sum of LFP_i for years 1967 to 1974, Heckman (1978) argues that the wife's labor market experience, $EXPW_i$, is an endogenous variable in the participation decision. The experience variable records the wife's previous work history and proves to be highly correlated with unmeasured determinants of current labor force participation. In the empirical analysis to follow, the endogeneity of experience is addressed and evidence is found for endogeneity of experience in the labor supply and participation equations. As in Heckman's research, no evidence of endogeneity is found in the wage equation.

Labor-Force Participation Functions

Tables 3 and 4 report the estimates of the normalized coefficients of equation (3). That is, if $e_3 \sim N(0,\sigma^2)$, the parameters of

TABLE 3

PROBIT ESTIMATES OF THE LABOR-FORCE PARTICIPATION FUNCTIONS OF WIVES WITH THEIR WORK EXPERIENCE EXOGENOUS

Type of household

	Full-time working husband rationed		Full-time working husband not rationed		Part-time working husband assumed not to be rationed	
Variable	Coeffi-cient	Asymptotic t-statistic	Coeffi-cient	Asymptotic t-statistic	Coeffi-cient	Asymptotic t-statistic
CONSTANT	-1.041	-2.964	-1.037	-5.027	-1.506	-4.655
EXPW	.255	9.921	.229	14.170	.271	8.990
EDW	.100	3.372	.104	5.688	.154	5.701
NWAGE	$-.721 \times 10^{-4}$	-1.077	$.294 \times 10^{-4}$	.640	$-.835 \times 10^{-4}$	-2.046
RACE	-.145	-1.165	-.165	-1.888	-.312	-2.208
KID05	-.321	-4.598	-.409	-7.943	-.271	-3.146
WAGEH	$-.566 \times 10^{-1}$	-1.848	$-.566 \times 10^{-1}$	-3.734	$-.405 \times 10^{-1}$	-2.648
LOG LIKELIHOOD	-310.025		-741.612		-239.865	
SAMPLE SIZE	580		1386		507	

TABLE 4

PROBIT ESTIMATES OF THE LABOR-FORCE PARTICIPATION FUNCTIONS OF WIVES WITH THEIR WORK EXPERIENCE ENDOGENOUS

Type of household

Variable	Full-time working husband rationed		Full-time working husband not rationed		Part-time working husband assumed not to be rationed	
	Coefficient	Asymptotic t-statistic	Coefficient	Asymptotic t-statistic	Coefficient	Asymptotic t-statistic
CONSTANT	-.713	-1.745	-.781	-3.510	-.647	-1.725
EXPW	.152	2.110	.140	2.499	-.103	-.921
EDW	$.904 \times 10^{-1}$	3.284	.104	5.091	.175	6.554
NWAGE	$-.535 \times 10^{-4}$	-.833	$.206 \times 10^{-4}$	.476	$-.120 \times 10^{-3}$	-2.753
RACE	-.101	-.845	-.148	-1.791	-.174	-1.280
KID05	-.288	-4.235	-.376	-7.353	-.324	-3.808
WAGEH	$-.521 \times 10^{-1}$	-1.809	$-.614 \times 10^{-1}$	-3.835	$-.293 \times 10^{-1}$	-2.001
WU-STATISTIC	1.634		2.354		3.803	
LOG LIKELIHOOD	-362.684		-848.504		-286.360	
SAMPLE SIZE	580		1386		507	

(3) can be consistently estimated up to a factor of proportionality, $1/\sigma$, using multivariate probit analysis. Table 3 presents estimates based on the assumption that experience is exogenous, while those estimates in table 4 are based on predicted experience. The instrumental variables used to predict experience are linear and squared terms of wife's age, education of husband and wife, nonwage income, race, children, unemployment rate, age of husband, his job tenure, his hourly wage, and all interactions with her age. As expected, education and experience increase the probability that a randomly selected woman works. Use of predicted experience in table 4 lowers the effect of experience and renders the coefficient insignificant in the case of part-time working husbands. An application of the Wu test, however, rejects the null hypothesis that experience is uncorrelated with the error term in (3) for part-time workers. This test consists of entering both experience and the residual of experience from predicted experience in the probit function. If the coefficient on the residual is significantly different from zero, one rejects the null hypothesis of uncorrelatedness of experience with the error term.

All remaining variables lower the probability that a woman works. The negative income coefficient indicates that leisure is a normal good, but is only significant in the case of households with part-time workers. The insignificant nonwage effects for wives of households with full-time workers may be attributable to the

elimination from the nonwage income variable of those flows likely to be contingent upon nonwork. The negative cross-wage effect implies that the husband's and wife's nonmarket time are gross substitutes. The presence of preschool children deters the wife from working. In table 4, the effect of small children on wife's labor-force participation decision is nearly equal across households. However, as will soon be seen, the effect of preschool children on hours-worked is not the same across households. Finally, within households, white women are less likely to work.

From the estimates of these probit functions, one obtains a consistent estimate of LAMBDA. What follows are estimates of the hourly-wage equation and the labor-supply functions for wives from these three types of households.

Hourly-Wage Equation

A closer look at the findings in table 5 show that the return to education in the form of higher wages is highly significant -- a significance confirmed by Heckman (1976). The experience coefficient is positive and highly significant, which is contrary to Heckman's findings. In part, that difference is attributed to the difference in data sources. The major difference, however, is in the definition of the experience variable. Heckman's experience variable is based on the response to questions recollecting past work experience and is subject to error. Even without error, Heckman's experience measure exerts a weaker, insignificant effect

TABLE 5

ESTIMATES OF HOURLY-WAGE EQUATION FOR WIVES

Variable	OLS regression (t-statistic)	Censored regression (asymptotic t-statistic)	OLS regression with wife's experience endogenous (asymptotic t-statistic)	Censored regression corrected for endogeneity of wife's experience (asymptotic t-statistic)
CONSTANT	-.314	-.674	-.260	-.820
EXPW	$.333 \times 10^{-1}$ (5.632)	$.778 \times 10^{-1}$ (8.853)	$.405 \times 10^{-1}$ (2.217)	.106(5.171)
EDW	$.986 \times 10^{-1}$ (15.872)	.118(16.794)	$.935 \times 10^{-1}$ (14.236)	.119(17.413)
RACE	$.310 \times 10^{-1}$ (1.040)	$-.307 \times 10^{-1}$ (.943)	$.389 \times 10^{-1}$ (1.293)	$-.356 \times 10^{-1}$ (1.234)
LAMBDA	-	.116(3.485)	-	.267(6.469)
WU STATISTIC	-	-	2.414	2.364
R^2	.168	.238	.153	.209
SAMPLE SIZE	1557	1557	1557	1557

because of depreciation. Lastly, the coefficient on LAMBDA in column 4 is positive and significant. Hence, these estimates are considered the "best."

Labor-Supply Functions

Estimates of the wife's labor-supply function are found in table 6(a), 6(b), and 6(c). Four columns of estimation results show the parameter estimates from OLS plus those from corrections for censoring, endogeneity, and both. OLS estimates are reported in column 1, the correction for censoring estimates in column 2, the correction for the endogeneity of the wife's experience estimates in column 3, and the estimates with corrections for both in column 4. Again, the correction for censoring in accomplished by inserting LAMBDA as a regressor into the hours equation.

Before examining these results, a discussion of those in columns 2 and 4 in table 6 must be made. In particular, the asterisks on the LAMBDA coefficients indicate that the other parameter estimates in the column are conditional on LAMBDA's coefficient being the starred value. If one regresses, without an intercept,

$$AHOURW_i \cdot w_i = k(-\phi_i + LAMBDA_i)w_i + e_i, \tag{4}$$

where $w_i = (1 + \Phi_i LAMBDA_i - LAMBDA_i^{\,2})^{-1/2}$, the regression coefficient, k, is a consistent estimator of $\frac{\sigma}{a_1}$, the coefficient of

TABLE 6A

ESTIMATION OF LABOR SUPPLY FOR WIVES OF FULL-TIME WORKERS

(Rationed)

Variable	OLS regression	Censored regression	OLS regression with wife's experience endogenous	Censored regression corrected for endogeneity of wife's experience
CONSTANT	817.207(3.736)*	-780.873(-3.640)	917.677(3.464)	-6[illegible](-2.4[illegible])
EXPW	46.477(3.147)	195.397(13.156)	41.493(.944)	[illegible].958(3.7[illegible])
EDW	50.575(2.861)	120.985(6.874)	44.441(2.498)	[illegible].215(6.3[illegible])
NWAGE	$-.980\times10^{-1}(-2.111)$	-.134(-3.128)	$-.990\times10^{-1}(-2.101)$	-.140(-3.261)
RACE	-160.446(-2.195)	-267.705(-3.681)	-154.109(-2.054)	-145.625(-3.307)
KID05	-236.220(-5.178)	-444.327(-10.388)	-236.296(-4.947)	-457.189(-10.301)
WAGEH	- 21.890(-1.203)	- 62.356(-3.490)	- 16.093(-.876)	- 53.957(-2.972)
LAMBDA	-	1099.70*	-	1287.85**
WU-STATISTIC	-	-	.308	4.053
R^2	.132	.425	.109	.333
SAMPLE SIZE	361	361	361	361
IMPLIED LABOR-SUPPLY ELASTICITY	.363	1.462	.310	1.167

*Asymptotic normal statistic.

**Explanation on page 20 of text.

TABLE 6B

ESTIMATION OF LABOR SUPPLY FOR WIVES OF FULL-TIME WORKERS

(Not rationed)

Variable	OLS regression	Censored regression	OLS regression with wife's experience endogenous	Censored regression corrected for endogeneity of wife's experience
CONSTANT	1085.32(8.223)*	-524.993(-4.003)	993.305(6.173)	-717.647(-4.854)
EXPW	67.093(6.966)	204.216(21.325)	187.141(5.136)	294.396(8.030)
EDW	15.295(1.424)	88.744(8.050)	- 18.943(-1.457)	63.345(4.855)
NWAGE	$-.586\times10^{-1}(-2.202)$	$-.393\times10^{-1}(-1.419)$	$-.514\times10^{-1}(-1.901)$	$-.304\times10^{-1}(-1.115)$
RACE	- 88.107(-1.695)	-256.065(-4.836)	- 56.980(-1.077)	-180.565(-3.349)
KID05	-248.231(-7.162)	-515.004(-15.898)	-205.390(-5.585)	-493.738(-14.452)
WAGEH	- 17.329(-1.821)	- 57.344(-6.231)	- 7.938(.745)	- 44.895(-4.495)
LAMBDA	-	1127.80*	-	1294.06**
WU-STATISTIC	-	-	-2.685	12.703
R^2	.119	.415	.097	.336
SAMPLE SIZE	859	859	859	859
IMPLIED LABOR-SUPPLY ELASTICITY	.489	1.490	1.365	2.147

*Asymptotic normal statistic.

**Explanation of page 20 of text.

TABLE 6C

ESTIMATION OF LABOR SUPPLY FOR WIVES OF PART-TIME WORKERS

(Assumed not to be rationed)

Variable	OLS regression	Censored regression	OLS regression with wife's experience endogenous	Censored regression corrected for endogeneity of wife's experience
CONSTANT	1005.60(5.033)*	-548.130(-2.684)	986.294(4.158)	-426.305(-1.790)
EXPW	40.184(2.603)	170.981(11.010)	96.144(1.451)	55.345(.852)
EDW	33.078(2.267)	116.262(7.825)	20.398(1.286)	131.752(8.896)
NWAGE	$-.583\times10^{-1}$(-2.241)	$-.997\times10^{-1}$(-4.257)	$-.479\times10^{-1}$(-1.655)	-.126(-4.682)
RACE	-153.643(-1.971)	-373.661(-4.763)	-162.235(-1.996)	-273.679(-3.338)
KID05	-189.715(-3.616)	-363.280(-7.339)	-169.148(-3.056)	-365.056(-7.107)
WAGEH	- 13.721(-1.488)	- 40.439(-5.388)	- 14.732(-1.535)	- 39.953(-5.200)
LAMBDA	-	961.606*	-	1155.03**
WU-STATISTIC	-	-	-.491	12.579
R^2	.093	.358	.080	.333
SAMPLE SIZE	337	337	337	337
IMPLIED LABOR-SUPPLY ELASTICITY	.298	1.269	.714	.411

*Asymptotic normal statistic.

**Explanation on page 20 of text.

LAMBDA in the hours equation. The starred values are these consistent estimates. (ϕ_i is the deterministic part of equation (3)).

As in Heckman's (1976) research, the findings herein suggest that censoring is a major consideration when estimating the labor supply of married women; witness, the diverse own-wage elasticities within each type of household. (Note: These estimates are obtained by taking the ratio of the experience variable in the labor-supply equation to the experience variable in the market-wage equation and dividing that ratio by average labor supply.) Further, as Heckman predicts, a comparison of columns 1 and 2 reveals that all OLS estimates are biased towards zero.

Second, a comparison of columns 2, 3, and 4 ("best" estimates) reject the null hypothesis that experience is an exogenous or predetermined variable. Again, the Wu test as applied to the regression in column 3 is implemented as in the labor-force participation equations. Unfortunately, not all of these t-statistics are significant. Since censoring is a problem and since LAMBDA is a function of experience, the Wu test in column 4 is an F-test on the coefficient of the residual of predicted experience from actual experience and the coefficient of the residual of predicted LAMBDA from actual LAMBDA. Predicted LAMBDA is obtained from estimates in table 4. The F-statistic is

significant at the 5 percent level in all three types of households.

Closer scrutiny of the labor-supply functions of the three types of household should begin with the wife's own-wage and income effects. The own-wage elasticity for wives of full-time workers whose time is not rationed is significantly larger than that of wives of full-time workers whose time is rationed. This suggests that her nonmarket time and that of her husband are substitutes. Moreover, the larger absolute value of the coefficient of nonwage income for rationed households in comparison to the absolute value of the nonwage income coefficient in the control group also spells substitutability between the spouses' nonmarket time.

The difference in the own-wage elasticities between households with part-time working husbands and households with full-time working husbands whose time is not rationed indicate a difference in tastes. In addition, implementation of the Chow test for the equality of the vectors of coefficients in table 6(b) and 6(c) rejects the null hypothesis of equality at the five precent level.

The difference in the income effects between wives of households with part-time working husbands and wives of households with full-time working husbands is also due to greater tastes for leisure. First, the difference in the effects between wives of households

with full-time working husbands whose time is rationed and wives of households with full-time working husbands whose time is not rationed is the "compensation" effect described in the previous section. In the absence of rationing, the income effect for wives of households with full-time working husbands is theorized to be that in table 6(b). Hence, the larger income effect for wives of part-time workers is again indicative of the greater tastes for leisure of these households.

The presence of an additional child under six has a profound effect on hours of work, particularly for wives with full-time working husbands. The presence of preschool children represents costs incidental to working -- costs which are among the omitted variables in the participation and hours-worked functions of married women. Such costs differ, however, between the wives of full-time workers and wives of part-time workers. For households with full-time working husbands, the costs incidental to the wife's working are money costs -- for suitable babysitters, for example. Evidence for this is the larger absolute value of the KID05 coefficient in households with full-time working husbands than that in households with part-time working husbands. In households with part-time working husbands, a husband can substitute his time for hers in the household.

In addition, for the wives of part-time workers, the costs associated with preschool children are job-related. Because the

part-time working husband works half the number of hours that his full-time counterparts do, the wife's income is essential to the household. As a result, the presence of preschool children incurs a loss of job tenure or job itself, and hence, a loss of income when she returns to the labor market. With an additional preschooler, then, the wife of a part-time worker surrenders fewer hours choosing instead to substitute her husband's nonmarket time for hers in the home.

SUMMARY AND CONCLUSIONS

This paper discusses two of the problems found in earlier research on the labor-market activity of married women. First, the assumption of freely varying choices within the household's utility function results in biased estimates of the wife's labor-supply elasticity. Depending on the substitute-complement relationship of the spouses' nonmarket time, pooling rationed and unrationed households can lead to a downward biased own-wage elasticity (as in the case of substitutability). With substitutability between spouses' nonmarket time, the income effect is also downward biased. Second, in the absence of rationing, pooling households with part-time working heads and full-time working heads will lead to similar biases as in the case of rationing versus nonrationing. Hence, estimating the labor-market activity of married women, spouse present, requires the researcher to account for the labor-market activity of the husband.

As in Heckman's paper (1976), estimating the labor-supply and market wage equations of married women using only a working subsample leads to biased coefficients. The estimates produced here confirm his findings. As Heckman points out, the consistent estimator used here is not efficient and warrants maximum likelihood procedures. This computationally simple estimator, however, does produce estimates close to those produced by the maximum likelihood estimator and is far cheaper to implement.

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APPENDIX A

DERIVATION OF SUPPLY ELASTICITIES

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Formally derived here are the properties of the wife's labor-supply function when her husband's time is rationed, her labor-supply function when it is not rationed, and the relationships between the partial derivatives of these two functions. Although the formal derivation of comparing demands when goods are rationed and when goods are freely variable is presented in the appendix of the Tobin-Houthakker (1951) piece, this derivation is a special case dealing with labor supply.

Again the familiar labor-supply model can be summarized by the following equations:

$$U = U(L_M, L_F, X) \tag{A-1}$$

$$X = w_M h_M + w_F h_F + A \tag{A-2}$$

$$H_M = h_M + L_M \tag{A-3}$$

$$H_F = h_F + L_F \tag{A-4}$$

Consider first the household where the husband's time is not rationed. One can combine the market and time constraints to obtain the full-wealth constraint,

$$w_M H_M + w_F H_F + A = X + w_M L_M + w_F L_F \tag{A-5}$$

where the price of X is one, the numeraire good. Maximizing the household-utility function subject to (A-5) yields,

$$U_X = \lambda \tag{A-6}$$

$$U_{L_M} = \lambda w_M \tag{A-7}$$

$$U_{L_F} = \lambda w_F \tag{A-8}$$

Again, $U_i = \partial U/\partial i$, $i = X, L_M, L_F$; λ is the Lagrangian multiplier. From these first-order conditions and the full-wealth constraint, the labor-supply function of each household member as a function of wages and nonwage income is obtained:

$$H_M = f_M(w_M, w_F, A) \tag{A-9}$$

$$h_F = f_F(w_F, w_M, A) \tag{A-10}$$

An examination of the total differential of the system of equations (A-5) - (A-8) reveals the qualitative properties of these labor-supply functions; this displacement system, in matrix form, is

$$\begin{bmatrix} 0 & -1 & -w_F & -w_M \\ -1 & U_{XX} & U_{XL_F} & U_{XL_M} \\ -w_F & U_{L_FX} & U_{L_FL_F} & U_{L_FL_M} \\ -w_M & U_{L_MX} & U_{L_ML_F} & U_{L_ML_M} \end{bmatrix} \begin{bmatrix} d\lambda \\ dX \\ dL_F \\ dL_M \end{bmatrix} = \begin{bmatrix} -dA - h_M^* \, dw_M - h_F^* \, dw_F \\ 0 \\ \lambda dw_F \\ \lambda dw_M \end{bmatrix} \tag{A-11}$$

where $U_{ij} = \partial^2 U/\partial i \partial j$, $i,j = X, L_M, L_F$ and the asterisks denote

initial equilibrium values of the variables.

Because of the symmetry between L_i and h_i, $dL_i = -dh_i$. Hence, the partial derivatives of the wife's labor-supply function may be written

$$\frac{\partial h_F}{\partial w_F} = -\lambda \frac{A_{3.3}}{|A|} + h_F^* \frac{A_{1.3}}{|A|} \tag{A-12}$$

$$\frac{\partial h_F}{\partial w_M} = -\lambda \frac{A_{4.3}}{|A|} + h_M^* \frac{A_{1.3}}{|A|} \tag{A-13}$$

$$\frac{\partial h_F}{\partial A} = \frac{A_{1.3}}{|A|} \tag{A-14}$$

where $|A|$ denotes the Bordered Hessian determinant in (A-12), and A_{ij} denotes the cofactor of the element in the ith row and kth column of A.

Second, where the household has a husband whose time is rationed, L_M is fixed and the household maximizes utility by choosing X and L_F. The full-wealth constraint is now

$$w_M H_M + w_F H_F + A = X + w_F L_F + w_M \bar{L}_M \tag{A-15}$$

The first-order condition for the rationed households are

$$U_X = \lambda \tag{A-16}$$

$$U_{L_F} = \lambda w_F \tag{A-17}$$

For this household the wife's labor-supply function may be written as

$$h_F = f_F^*(w_F, w_F, A) \tag{A-18}$$

Similarly, the matrix representation of the total differential of (A-16) and (A-17) is

$$\begin{bmatrix} 0 & -1 & -w_F \\ -1 & U_{XX} & U_{XL_F} \\ -w_F & U_{L_F X} & U_{L_F L_F} \end{bmatrix} \begin{bmatrix} d\lambda \\ dX \\ dL_F \end{bmatrix} = \begin{bmatrix} -dA - h_F^* dw_F - \bar{h}_M dw_M \\ 0 \\ \lambda dw_F \end{bmatrix}$$

Let (A-19)

$$A^* = \begin{bmatrix} 0 & -1 & -w_F \\ -1 & U_{XX} & U_{XL_F} \\ -w_F & U_{L_F X} & U_{L_F L_F} \end{bmatrix}$$

The partial derivatives of statement (A-18) can be written as

$$\left(\frac{\partial h_F}{\partial w_F}\right)^* = \frac{A^*_{3.3}}{|A^*|} - h_F^* \frac{A^*_{1.3}}{|A|} = \left(\frac{\partial h_F}{\partial w_F}\right)_{\bar{U}} + h_F^*\left(\frac{\partial h_F}{\partial A}\right)^* \tag{A-20}$$

$$\left(\frac{\partial h_F}{\partial A}\right)^* = -\frac{A^*_{1.3}}{|A^*|} \tag{A-21}$$

The relationships between the partial derivatives of the wife's labor supply for the two types of households can be obtained by using Jacobi's theorem on determinants.

From this theorem, one observes that

$$\frac{A^*_{ij}}{A^*} = \frac{A_{ij}}{A} - \frac{A_{i4}}{A}\frac{A_{4j}}{A_{4.4}} \qquad \text{(A.22)}$$

Using the relationships in (A-12), (A-14), (A-20), and (A-21), and rearranging terms in (A-22), one can solve for the difference in the compensated own-wage effects.

$$\left(\frac{\partial h_F}{\partial w_F}\right)_{\overline{U}} - \left(\frac{\partial h_F}{\partial w_F}\right)^*_{\overline{U}} = \frac{\left(\frac{\partial h_F}{\partial w_M}\right)^2_{\overline{U}}}{\left(\frac{\partial h_M}{\partial w_M}\right)_{\overline{U}}} > 0 \qquad \text{(A-23)}$$

Similarly, one can obtain the difference between the pure income effects:

$$\frac{\partial h_F}{\partial A} - \left(\frac{\partial h_F}{\partial A}\right)^* = \frac{\left(\frac{\partial h_F}{\partial w_M}\right)_{\overline{U}}}{\left(\frac{\partial h_M}{\partial w_M}\right)_{\overline{U}}}\left(\frac{\partial h_M}{\partial A}\right) \qquad \text{(A-24)}$$

and the difference between the uncompensated own-wage effects, which is obtained by adding (A-23) and (A-24), yielding

$$\frac{\partial h_F}{\partial w_F} - \left(\frac{\partial h_F}{\partial w_F}\right)^* = \frac{\left(\frac{\partial h_F}{\partial w_M}\right)_{\overline{U}}}{\left(\frac{\partial h_M}{\partial w_M}\right)_{\overline{U}}} \left(\frac{\partial h_M}{\partial w_F}\right)$$

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